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ABSTRACT

This report presents the proceedings of a conference on career opportunities for women in mathematics and the sciences. In keynote remarks, Eloise Clark discusses how the recently passed National Science Foundation Authorization Bill for 1981 provides for the participation of women, minorities, and the handicapped in science, and outlines some of the problems that might be expected in implementing the legislation. Dr. Clark furthermore discusses future challenges to science and technology that will be posed primarily by financial support considerations. Anne Briscoe emphasizes that in the struggle for equal employment opportunities, women and other minority groups must work together rather than compete with one another. Jonathan Cole discusses the issues involved in combining career with marriage, the community role in recognizing equal opportunities for women, and Federal support for women's participation in science. Francine Essien describes the factors that might influence women's decisions to mix a science career with family responsibilities. Lilli Hornig describes some measures women might take to maintain and improve progress toward women's participation in science. Finally, Eileen Poiani discusses the improving current status of women in mathematics and future career prospects for women mathematicians. (MJL)

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GROWING OPPORTUNITIES FOR WOMEN IN MATHEMATICS AND THE SCIENCES: Proceedings of a Conference sponsored by Womanspace: Career Options Program for Women, Columbia University with support from the Exxon Education Foundation and Conoco, Inc.

February 28, 1981

Editors:

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Perspectives on Women's Participation
in Mathematics and Science

Eloise Clark
Keynote Speaker

I must say that coming to Columbia to participate in your conference has very special connotations and pleasures from my point of view. I think there is a certain symbolic value in being able to return for an occasion that is oriented toward enhancing the participation of women in science. I also think that corporate sponsorship of the conference may augur well for the emerging opportunities that will be available to women in the industrial setting of the future.

I would like to share a few thoughts with you about science in general and some of the issues confronting the National Science Foundation. Colleges and universities have been the most prominent place of employment for professional women in science for the past several decades. Unfortunately, the representation of women in the ranks of these institutions has remained disproportionately among the lower positions. In the major research universities, women are often minimally represented in the senior professorial positions. I believe, however, that there are signs that access is improving and I expect that the future will be brighter; I'm sure that many would prefer to see an accelerated rate of change in this area.

Part of the desire to speed opportunities for women

was reflected in the recent passage of the National Science Foundation Authorization Bill for fiscal year 1981. Passage of the basic enabling legislation that authorized that foundation's historical functions was accompanied by a special addition to the bill called "Equal Opportunities in Science and Technology." This part of the bill included new and specific attention to the authorization of funding for a variety of programs relating specifically to women in science and others who traditionally had less access: minorities and the handicapped.

For the sake of accuracy, I want to indicate that the introduction of the bill was not initiated by the National Science Foundation. Rather, a number of dedicated individuals and women's groups worked to draft the legislation and to encourage its passage by Congress. Various stages of the process took several years. Multiple efforts initially spearheaded by Senator Edward Kennedy were made to present the bill on the floor of the Congress as a separate bill for purposes of holding hearings and debate. The bill was then redrafted, underwent major revisions and was reintroduced on the hill a year ago as part of the NSF bill. During the course of the congressional hearings of the past year, considerable negotiation spearheaded by women's movement representatives expanded the content of the bill to include attention to minority and handicapped scientists as well. Finally, in the Fall of 1980, the bill was passed and signed into law. I belabor the events a

little bit as a way of indicating the length of time it sometimes takes to bring about legislative change or activities that provoke legislative change.

The NSF bill involved the participation of four separate committees on the Hill: two in the Senate and two in the House. In addition, the NSF, a government agency, and the White House administrative staff were involved, and all of these parties had to negotiate an agreement and achieve a sense of what would be acceptable final legislation.

I'll list some of the key provisions of the bill and then talk about the nature of the controversy surrounding the bill. The primary objectives were to increase the participation of women at undergraduate, graduate and post-graduate levels in scientific, engineering, and other technical fields, to encourage women to consider and prepare for careers in science and technology, to provide training and fellowship opportunities, etc. In order to accomplish these objectives, the bill set forth a number of programs whereby NSF would establish a visiting women's science program and support activities to improve the availability and quality of public information directed toward the importance of women's participation in scientific and technical careers. The workshop that you're attending today is a good example of the type of activity the bill would sponsor. Another example is the creation of national research opportunity grants for young women who are within five years of receiving Ph.D.'s and those who have received

doctorates and are now attempting to return to research after interruptions in their careers. In some cases, planning grants would be authorized to assist in this process.

In addition to overseeing the functions already mentioned, the foundation was directed to establish an advisory committee, one subcommittee of which would be oriented toward women in science and technology. The advisors of these committees are to be representatives from the outside world as opposed to staff members of the foundation.

Various reports and data sets were directed for the general purposes of monitoring the progress of women in the labor force (their numbers, salaries, promotional opportunities, etc.), apprising Congress of this information and making recommendations for further improvement in this area.

Now, this was really an omnibus bill, and it begins to sound as if it might open doors to lots of opportunity for those women who have chosen careers in science. But at the risk of being a little bit crass, I have to mention that subject of money. I indicated when discussing the legislative process that this was an authorizing bill. In other words, Congress gave the foundation the legal authority to spend money for the purposes established by the bill, but passage of the bill did not provide funds nor appropriate money directly from the U.S. Treasury. That action did

occur during the Fall of 1980 (for fiscal year 1981); however, funds were appropriated with a ceiling. In other words, new money or additional funds were appropriated to the foundation's budget, and in addition the foundation was told that it could spend no more than $6 million specifically on the research opportunity grants portion of the bill. This leads directly to controversial parts of the bill. Considering the lean times that everyone is facing now as far as budgetary conditions are concerned, the problem of new money or, as it's often called in Washington lingo, the "add-on" can be a subject of much debate. If a program that was not included in your budgetary requests is initiated, then any funds to establish it must be taken from other programs that you had put forward in your requested allocation. In other words, you are now redirecting funds toward the new purpose. I don't need to spend a lot of time on that because I'm sure it's easy for you to see that the people who were threatened with losing money to start the new program wouldn't be particularly enthusiastic about initiating it.

Another point is related to the classic tension that exists between the legislative branch of the government and the executive branch. This relates to the statement I made earlier that the foundation had not initiated the program; rather, the active women's groups and their supporters were the effective lobbyists for getting this program into the Congress and approved by the Congress. This means that since the program had not been part of the agency's bill, or for

that matter the President's bill, there was jockeying for position. If the foundation acquiesces too easily, then they've caved in to congressional mandates. On the other hand, they should not be perceived as uncooperative or unwilling to carry out the mandated laws of the land, so to speak. In a very simplified way, this is the kind of tension that arises between the two branches of govennment in the development of legislation.

But the controversy goes beyond this because various women have different opinions on the bill and a number of them have expressed a great deal of concern. Some argue that the bill poses the threat of their being labled second class because it will be perceived as a special funding program. I hasten to add that there are many other women who say, "Forget that. The problem is that we would like to have funds to get ourselves started to do our work and to be judged on the basis of our contributions as recognized scientists." In the early days of the passage of the bill, feelings on this side were running pretty high, but a lot of that has subsided, and it seems to me that the bill is generally well received. I had hoped that I might describe the bill in a great deal of detail and say specifically how NSF might intend to handle it, but as most of you are aware from accounts in the newspapers, the government agencies at the moment are revising or amending our budgets to present to the Congress. Mr. Reagan is now President, and so various changes in the initial budget are being requested. Until the

information is received by the Congress and made public (and that will occur around March 10 or later), specific details of the budget will not be available. But as most of you are aware, the effort is strongly oriented in the direction of reduced funding and reduced varieties of programs.

I wanted to present a little bit of the history of the bill, partly to give you some sense of the difficulties associated with achieving goals by legislative action. It may sound discouraging, but I did not intend it in that vein. It's realistic, though, to recognize that the activity takes a long time and that our progress in society moves and grinds slowly forward. So don't give up. Things are improving.

To move away from matters of specific concern to women, I would like to take advantage of you as an audience and highlight just a few science general policy issues. I do this because I believe it puts forward the context in which all of us, especially those who aspire to stay in the scientific and technical areas, will work. Our decisions and opportunities are affected by the general environment. We should be sensitive to the need for greater public awareness and understanding of science and the potential of its results.

There are data that suggest the need for renewed commitment to developing a national research and educational capability in science. Looking at research administration as it relates to the university situation, it does appear to many in my end of the business that attitudes and national policies have been in a state of transition for some time.

The general problems relating to future funding for federal support to science and generalized fundamental research in particular, I think, are somewhat uncertain; they vacillate on a yearly or biennial scale. We've built a major research enterprise on our college campuses, but we are seriously falling behind in maintaining it in a state-of-the-art form. This is strange at a time when there is a general expectation that science will provide solutions to a lot of the nation's problems. At the same time, it happens at a time when the excitement of discovery in many fields abounds and when I believe one of the major problems of our society is just learning to adapt to the ever-accelerating rate of change brought about in part because of science and its discoveries.

I believe that this will remain a major challenge for the future. We do see increasing evidence that science and technology will form components of public policy matters. But, taking the inflationary component into account, the amount of support for basic research provided by the federal government has increased only about 8 percent over a 13 year period. The increase has not been evenly distributed: the biomedical fields grew by about 19 percent, largely because of the growth in support of cancer research; environmental science grew by about 34 percent. So as not to distort the percentage comparisons between these fields, keep in mind that oceanographic sciences and atmospheric research were essentially new sciences moving into a period of strong scientific advancement at the end of the 60's and during the early 70's: they

started from a very low base and grew during this period. Looking at a few others, engineering support grew in a fairly strong way but not nearly at the level needed to keep up with the current demand for engineering on the nation's campuses and within its industrial setting. These increases average only about 8 percent overall because, while some fields were growing, the physical sciences in particular dropped dramatically by about 15 percent. This again is in part associated with decreased support once the moon shot had taken place.

Now, while I have indicated that the bio-medical fields grew, other fields in the life science areas did not show the same strength. Psychology spending was reduced; social science research support has remained approximately constant; botany and environmental biology have not shared in the growth period. While it's true that we recognize 1967 as a high point for federal support, I think the fact that support has since fallen by some 46 percent is a little bit worrisome.

Focusing on the near term, though, the situation has improved. I don't anticipate major growth, but I do believe that there is probably a commitment to stabilize funding now. I believe there is a greater awareness now that, while we have been living on the fruits of our prominent scientific discoveries, there is a need to maintain the stability of the base. This understanding leads me to think that there will continue to be considerable opportunities in the field,

in academia and in the new fields of industry.

I'm a fan of Lewis Thomas; if you haven't come across him, I hope you will make an effort to look for his editorials and other writings. I would like to close with a paragraph from his article in Discover, March 1981. He says:

> We've started to do science on a world scale and to rely on it and hope for it, not just scientists, but everyone, and not for the hope of elimination, but for the sure predictable prospect of new technologies which have always come along like spray in the wake of science. We need better ways of predicting how a new piece of technology will turn out, better measures on an international level to shut off the ones that carry hazard to life off the planet. We will have to go more warily with technology in the future, for the demands will be increasing and the stakes will be very high. Instead of coping or trying to cope with the wants of four billion people, we will sooner or later face the needs, probably desperate, of double that number and perhaps thereafter double again. The real challenge to human ingenuity and science lies in the century to come.

I think that's a very hopeful and challenging note on which to end.

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Anne Briscoe:

Distinguished guests and members of the conference, as Dr. Edmundson indicated, Yale University granted me a Ph.D. in Bio-chemistry 32 years ago. Since I was 30 years old at the time, I have spent more than half my life as a doctoral scientist. I'm one of the women who have worked continuously, although we were sometimes told that women don't. I've always had a full-time job and, with it, some sort of part-time job in teaching or consulting. As far as my full-time positions are concerned, I've been in just two university medical schools, so in the 31 years since I finished my post-doctoral fellowship, I've had two jobs and one marriage.

So I'm speaking to you from a middle-aged perspective, and I propose to start the debate with some provocative statements. First, you who are young in years or career stage (two ways of being young) can have a career in science. More fields are open to you than were open to my generation and I think the opportunities are somewhat better.

My second point is that you are still disadvantaged as a woman; that is to say, you are a creature with a genetic defect because you lack a Y chromosome. And if you are a minority woman, then it's a little harder. You're all going to have to be better qualified and to work harder

than white males. Maybe this isn't as difficult as it sounds because, despite all the propaganda to the contrary, men are really just average. They're no more brilliant than you or I, maybe less.

Now, my third point is that improvement in career opportunities is due in large measure to the black civil rights and the women's rights movements, and to the affirmative action requirements that resulted from the impact of these forces on the decision makers at a crucial time. Some of these men were truly motivated to extend opportunities to the historically disadvantaged; some were simply caught up in the liberal momentum generated in the 1960's.

Now, four: science is not a religion and the world of science is not run by male saints. The scientific establishment is male and white, and they are no different from men in business or government or labor unions or the media. That is to say, they are not different with respect to morality, power politics or even objectivity. They are not more noble, idealistic or altruistic. Like all men, they want to pursue their own interests and in the course of this to acquire power, money, prestige and even fame. They want to fulfill themselves as individuals and to provide for their families. In these respects we women are similar to them but not identical. Because I think that women are more idealistic and less directed toward the political aspects of the workplace, to our detriment.

Now, getting back to the problem of the scientific

establishment: why does it matter who runs things? The answer, of course, is that whoever does, determines the distribution of the means of attaining one's goals. They decide who gets the job, who gets the fellowship or the research grant, whether a scientific paper is published or rejected, who is permitted to present papers at scientific meetings, who presides over the sessions and gets visibility and prestige. It is a long story as to how the Association for Women in Science was founded and how it initiated a lawsuit against the Director of the Department of Health, Education and Welfare and the National Institutes of Health, but the bottom line is that the percentage of women members rose from less than two to about 20. It was supposed to have gone up to 33 percent before any more men were appointed. But of course as soon as it reached 20 percent, there were screams that there weren't any more qualified women.

Now, the fifth point I have to make is that pressure groups--women's and minority persons' advocacy groups--have made a difference, and you must support them. If you get a good break, that's all the more reason to help people who are still having trouble bucking the system. And make no mistake about this: affirmative action programs are responsible for the increased opportunities for all disadvantaged groups. These programs have been required by executive order and federal laws, and it's true that enforcement has lagged in many instances. Nevertheless, no other force in society has ever resulted in such widespread raising of male

consciousness and conscience or, to put it another way, has resulted in acceptance of women and minority persons as a lesser evil than loss of federal funds.

There can be no valid argument that academic institutions and large companies have made more opportunities for employment and for upward mobility than they absolutely had to. But it has made a difference. Women are working in jobs and at job levels that were never open to them before, getting into training programs, moving into executive positions--unheard of before "women's lib" became part of the vocabulary.

Of course, along with that are the accusations that affirmative action lowers the standards. I will let Dr. Hornig deal with that issue as I have heard her do in the past. I'm interested in the practical side: should we separate women from minorities in this struggle just because our starting points, our history, is a little different? My answer is absolutely no. If we want to win, we don't want to be fragmented. Our adversaries would like to divide us, and they have a lot of reasons why our problems should be seen as separate. But together we have clout, and we must not compete with each other. We must not lose our sense of mutual sympathy and common purpose, which is, of course, social and economic justice for all.

Jonathan Cole:

Well, after Professor Briscoe's remarks I am tempted to pass. I've had the honor before of being a token, and indeed it is an honor again to be here with you on this occasion, which I think is an extremely important one because it demonstrates such interest in what I concede to be a very important problem. Now, why did I get here in the first place and how did I get here?

I got here through my work in the sociology of science and my attempt to attend to a seeming anomoly: despite a lot of research showing that science operated to a tremendous degree with a great deal of fairness in its distribution of resources and rewards, there was a great deal of the sense that women were treated differently in an unfair way. That lead to a decade of research that has dealt with the position of women in the scientific community today and yesterday and speculations about where they will be tomorrow.

In considering this, I think there's good news and there's bad news, and I would like to pick up on some themes which have already been aired. I think it is surely fair to say that women today occupy less marginal positions in the scientific community than they did in the historical past. Examining biographies and autobiographies of women in the early part of this century, we will see statements which amaze us. For example, Otto Hahn, in his autobiography, describes the experiences of

a colleague of his for many years. Describing her situation as a researcher in science, he says that the beginning was difficult for her. Emil Fischer, the Director of the Chemical Institute, did not then accept women, but he did make a consession in her favor with the condition that she was not to enter the laboratories where male students were working. She was permitted to work with Hahn in the woodshop. In 1907 this was a large concession.

I think we've come a fair distance from that point, but we haven't come far enough. Let me cite several brief statistics to show the kinds of progress that I think have been made and then try to outline some themes which I hope we will return to--problematics that have to be tended to if we are to fully consider the future of women in the scientific community.

The proportion of women Ph.D.'s has increased dramatically in the last decade. In mathematics, for example: in 1969, women represented 5.2 percent of doctorates, and in 1978, 14.3 percent. Chemistry: 7.5 percent went to 12.7 percent; physics and astronomy: 2.6 percent went to 4.9 percent. Obviously one can see a dramatic growth, but still the overall percentages are rather small and in some sense disquieting. Nonetheless, I think it is fair to say

that women are no longer alone, in a sense, in science. They are more apt to find other women in science, both in graduate school and in science departments, laboratories, and industrial settings.

Their marginality has been reduced, but surely it has not been eliminated. I think cultural definitions about the inappropriateness of women entering into scientific careers have weakened, but in many quarters they still prevail. Gender discrimination in various forms has weakened in many areas, but it has not been eliminated. It's been pointed out by many of us that certainly in the areas of promotion, high academic rank and academic organizations there still seems to be a remarkable resilience of discrimination; surely there's a paucity of women in highly ranked academic positions.

But I want to outline several themes which I hope we will return to. One is the importance of career management among women. Professor Harriet Zuckerman and I are now engaged in a fairly extensive study involving in-depth interviews with women and men scientists. Although we're only at the beginning of our effort, which incidentally is sponsored by the National Science Foundation, it is very clear that issues of career management have an important role to play in the entire career structure for women.

Many women have already indicated that they tend to slip into choices and are constrained in a variety of ways, not only by conditions within the academic setting, but also

by conditions outside academia--their local environments and their families, etc. They've also suggested to us that choices are made without their knowing exactly why they are being made; there really isn't a process of decision making. Not many of us are so rational that we sit down and outline our careers in advance, but I think it is fair to say that, for whatever reasons, men are more apt to actually manage their careers in a kind of organized, rational fashion than women--or at least this is the hypothesis that we are beginning to address.

I think that another important theme for us to reflect upon is the importance of getting the proper training as a launching pad for a scientific career. Almost all studies I have seen dealing with women in science suggest that the quality of Ph.D. training and the location of the initial job are very strong determinants of the career paths which follow. It is also strongly suggested that mentors and individual sponsorship play a role in subsequent careers of women. So, for all of you who are contemplating either returning to science or pursuing science further, I think the rational selection of a Ph.D. institution that will really meet your needs and can help you launch your career is a decision extraordinarily critical to the longterm career prospects not only of women but of all scientists.

It has often been asked whether or not women can simultaneously manage productive scientific careers and maintain homes and families. Increasing amounts of research suggest

that they can, though not without hardships. Certainly there is no strong evidence that married women are less scientifically productive that unmarried women. Indeed there is evidence, some of which I've collected, some of which has been questioned in some quarters, that women who are married and have one or two children are actually more scientifically productive than those who are unmarried. After two children, productivity seems to fall off. This does not hold in all cases, obviously.

I want to suggest just one or two more things. I think that, while many paths to more status equality in science for women are emerging, there is a whole other dimension where the community may not be living up to its meritorious ideals; this has to do with aspects of what I call the social citizenship. By this I mean the informal aspects of science, the extent to which women are invited to various kinds of scientific meetings, whether or not they're invited out to the local bars to discuss science over drinks, the extent to which they carry out informal discussions, interactions and communications with other scientists and the extent to which they may be excluded from those "invisible colleges." And it is incredibly important, since a great deal of science goes on in that kind of informal setting, that we make progress in breaking down barriers to informal arrangements of what I call social citizenship.

Finally, I think the one issue that we must deal with is the effect of federal cutbacks in federal support for

science on the career potential of young scientists. At this point it is not altogether clear what the effects will be on women, who are more apt to be in the younger ranks and where there are fewer tenure opportunities. The logical thing to think is that the people last in are first out. And in many ways women who enter science now, when there are fewer opportunities for promotion to high rank, are at a much greater risk--all the more reason why I would concur with Professor Briscoe that they must maintain a great deal of vigilance in putting pressure on the appropriate pressure points. Some of that comes in the form of affirmative action, but it also comes in the form of organizations which are collectively looking out for the interests of young women scientists.

Francine Essien:

Like Dr. Clark, I also have memories of being on the Columbia campus--in my case, after I left Temple University and before I started at Einstein College of Medicine. When I was a biology major at Temple, no one had advised me to take biochemistry or physical chemistry; when I was accepted into Einstein my advisor thought it would be a good idea if I took physical chemistry, at least, and her suggestion was that I take it during the summer. Of course, since Einstein is a medical school, they don't have an undergraduate component to teach physical chemistry, so I came to Columbia

under the sponsorship of Einstein and suffered through the summer with physical chemistry. I will always remember that as I walk on campus.

If I can just make a point here, for those of you who are now making or contemplating career changes, adequate preparation is extremely important. Perhaps in some of the workshops we can bring this up again. For example, I would advise any biology major who wants medicine or research--even if she doesn't know exactly which field she's going into--to take biochemistry and if possible physical chemistry and computer science. This way, by the time she is ready to make that decision or change, she will have a good basic preparation and won't have to go back to school for these basic courses.

I'd also like to touch upon the personal aspects of being a woman in science. Among students who talk to me, I find that many who hesitate about entering engineering or science or math are basically concerned about the effect such a career decision will have on their personal lives and their personal choices. And I must echo Dr. Cole that in fact you can find within the science fields a fantastic range of lifestyles, but you should be very realistic in terms of what that may mean. As Dr. Cole mentioned, I don't think any of you should have your decision about a career in these areas determined by the fact that someone has told you, "Well, women who are scientists and women who are physicians just cannot have families." There are too many of us who demon-

strate the fact that that's not true. I've said that it's possible to have a career in science and to have a family, to do fingerpainting if you want to, or art or whatever, but in all honesty, because of the way things are set up in society now, it is extremely difficult and very challenging. And so I won't sit here and say that it's a piece of cake.

Everything depends upon how important your choice is to you. If you feel that as an individual you have a right to the kind of career you want and you also have a right to your own personal lifestyle, if you want to make the decision to have a family, you can have the combination, but it takes a lot of work. And it depends on the specific area you go into. (For example, I'm in academia and doing research.) In some kinds of research, in the biological or physical sciences, you can't take work home. You have to be in the lab. If you want to be competitive with your male colleagues, this kind of work may require very long hours in the lab. That's real for many fields. The long hours required for research mean that in fact you have to have some support systems available to you. This becomes extremely important in terms of your personal choices; that is, you'll find that many women in science who are married and have families, have very supportive husbands, or they have housekeepers, or they have aunts or whoever, who come in to help them. So again I'll just make the point that it is possible, but it is extremely demanding. I think, however, that the rewards are worth it, and there are many women in science who apparently

agree, because they do manage to have both.

Now the other end of this: I want to emphasize that there is a great variety of lifestyles. I have many women friends in science and technical fields, and I'm sure many of the panelists do also, who made the decision not to have a family, and they also have very successful careers. This is just to again hammer home the point that your personal lifestyle is a decision separate from your decision to enter these careers.

Let me just add another point here in terms of the point made by Dr. Briscoe about minority women in science. It is a very real problem that minority women who want to enter science are faced with a double bind: the fact that they are women and minority group members. They suffer from both aspects of the discrimination that has been present in our society. I would say that for minorities in general, and indeed for all women, there are some fields of science where you will still run into a great deal of conservatism and resentment and some sentiments reflecting the nineteenth century. You have to have a very strong sense of self; you have to be extremely confident; you have to be aware of your own special talents and abilities, because you will run into those who will assume you have obtained your position because you are a woman or a minority member and not because of your ability. You will always find someone who will look at you as a token and think that you are where you are because of Affirmative Action, and that's all. If

that kind of thing bothers you, you will run into some problems. The way to handle that is to ignore it and develop your own special source of strength and resistance.

In terms of speculation about the future of women in science, you'll have to open up your minds and be much more imaginative than people have been concerning science. In the past, people thought of sciences as very discrete boxes; you were either a physiologist or a biochemist or a cell biologist or a botanist or this or that. With all the changes occurring in science today--cutbacks, greater influence from the private sector--you'll have to start looking at career opportunities outside of traditional disciplines and outside of traditional job markets. One of the traditional job markets for scientists has always been academia. Unfortunately, because of the declining population and cutbacks and other changes, there will be fewer academic appointments in the future and the few that exist will be very competitive.

The exciting thing, however, is that there will be an increase in opportunities in the private sector and in interfaces between government and private sector, government and academia, etc. If you have been reading your newspapers and magazines of the last year or so, I'm sure you're aware of this. For example, the job market is really fantastic now for individuals who are interested in genetics and molecular biology. You have all heard of corporations like Gene , who is trying to buy geneticists for $30,000 to

develop products for medical application. Developments in science are reported on the financial pages of newspapers because of this increased importance of science in the private sector.

In closing, I would suggest that in considering future career possibilities you be very flexible and adaptable, get good basic training and be prepared to combine interests. For example, for students who may have in interest in law and an interest in science and can't decide whether to become lawyers or scientists, there are very interesting ways of combining both interests. I have a friend with both interests; she is now an environmental law specialist for a big company. She uses her science background in her work relating to environmental issues. That's the kind of thing you should think about in looking at the future. Get away from traditional boxes where you have to be either this or that, be prepared to take greater advantage of the private sector, and be prepared to combine your interests so that you can apply them in science and technology in new and exciting ways. Thank you.

Lilli Hornig:

Let me join my colleagues in welcoming you all here this morning. I was a little shocked to realize that after most of my adult life, spent not in New York but in this general vicinity, and having been to Columbia many, many times,this

is the first time I have been here on my own. I got invited. I did not come as a spouse today. That's in some ways the brightest thing that's happened in my life recently. In the period since the new administration took over in Washington, I've been reviewing, in a broad kind of way, what is happening to programs for women and minorities and what the administration intends to have happen. It dawned on me that we are entering a revival of the Victorian age of chivalry. The policy that's evolved is quite clearly that when programs have to be abandoned, the motto is women and children first. The problem is that it's not clear where the lifeboats are, and I think we'd better start swimming.

What I'd like to talk about this morning is some of the things we can do to stay afloat and in fact make some progress toward where we're going. And in order to do that I want to review only very briefly what has occurred in the last decade. Several of my colleagues have touched on this already and I don't want to be too repetitive.

What used to be true only ten or fifteen years ago was that women were such a small fraction of scientists that their voices were simply not heard, nor were they in a position to shape the futures of their own disciplines. That situation has changed simply through increasing numbers. In most of the behavioral and biological sciences, there are now such large numbers of women, among the recent graduates at least, that it's a radically different situation. In the physical sciences things are happening more

slowly.

But there are women everywhere and, as Professor Cole quite rightly suggested, we need no longer be alone. We have colleagues, whether or not the male ones want to talk to us. What's most impressive about what is going on is not the change in the labor force composition people frequently cite; very little has happened there. It goes from nine percent women scientists to ten percent women scientists, and that's not impressive. Look at the rate of change in the individual fields. I will not burden you with individual numbers, but there are areas in engineering and agricultural science and some of the environmental sciences where women's participation is doubling annually. That is a truly astonishing figure even in this era of double digit inflation.

What I want to focus on is what those increases mean in practical and political terms and what the trends signify for the future. The very first thing to note about this growth of women in scientific disciplines at all levels is that it's taking place against a backdrop of an actual decline in the numbers of men in those fields. In fact, it can be said that women are saving science education from a state of rapid decline and that's been true now for the last ten years; it's something you hardly ever hear anyone mention, but something we should be saying very loudly because in fact it is we who are saving our male colleagues' jobs. That should give us a little more clout, not that we have

a great deal of it yet.

It remains true that all other things being equal and even allowing for Professor Cole's studies, which I'll be happy to discuss in more detail if anyone wants to, science has not been very fair to women. I call your attention to a series of reports that our Committee on Women in Science and Engineering has issued through the National Academy of Sciences. There is a third report in that series about to be issued on a large study of matched samples of male and female scientists and it leaves no question that discrimination exists. I'm happy to defend that point of view to anyone.

Women scientists find it harder than men to find jobs in all employment sectors. They are more often hired at lower levels. They are slower, significantly slower, to be promoted, through no fault of theirs. They find great difficulty in attaining tenure in academic jobs or management levels in industrial jobs and they are consistently underpaid. They turn out to be over-represented at all the lowest paid levels in all the lowest paid employment sectors, particularly in hospitals and clinical research where they also suffer, if they're not M.D.'s, from the inevitable tensions between M.D.'s and Ph.D.'s. They are shockingly under-represented in prestigious institutions at tenured levels.

It's particularly interesting to note that these differences all seem to develop after the degree has been

earned. At whatever educational level we compare them, men and women working toward degrees are in fact quite equal in terms of ability and potential. Certainly all measures of quality and achievement are equal at pre-degree levels. In fact, if they weren't, you would have to suggest that the institutions are prostituting themselves by taking women's money and giving them degrees for lower achievement. I'm sure no one would want to feel that way about academic institutions.

Actually it would be surprising if differences did not speedily develop after the attainment of the degree, and those are in fact the ones that Professor Cole has so ably chronicled, along with other scholars in the field. The problem is that by virtue of how women are distributed in employment--in the lowest paid sectors and the lowest paid occupations--they are not in positions that give them access to the tools of research. By tools I mean, very broadly, money, facilities and graduate students. Because in the experimental sciences you really don't do research without graduate students. To have graduate students or other kinds of assistance you need an independent, autonomous situation in which you are able to determine what direction your work takes, to obtain funding for it, and to direct it as you see fit.

The fact that women are productive in research at all is of some surprise to me, because so few of them are in the positions where that kind of autonomy is even possible.

Two or three years ago, when we last looked in detail at some of those distributions, we took a hard look at the 25 top-ranked universities in this country; they represent about ten percent of all Ph.D. granting institutions and grant about 40 to 50 percent of all Ph.D.'s. Among their faculties in mathematics, for example, two years ago there were 12 women who were full professors in all those 25 institutions. In chemistry, which has a similarly unenviable and richly deserved reputation for bias, there were 14 women who were full professors. Under these circumstances, it's my assessment that research productivity of women scientists is in fact astonishingly high.

After that little digression, let me return to what I think the changing patterns in education mean. One very striking conclusion is that the patterns of men and women are converging. That may seem sort of obvious; men and women now go to college in equal proportions, which a few years ago seemed an unlikely prospect. They are converging with respect to access to higher education in all but a handful of institutions that still maintain biased or skewed sex ratios. They're converging with respect to curricular patterns and distributions with respect to attainment and, perhaps most importantly for scientists, with respect to timing at the advanced levels.

One of the well worn cliches of male scientists is, "The trouble with women is that they're quite good, but they drag out their Ph.D.'s forever; they're middle-aged by the

time they graduate, and what can you expect at that age?" Well, I have a surprise for those people: in many of the science fields, women now get their Ph.D.'s just a shade faster than men. People are always worried or surprised by that, but what is interesting is that those women who get those degrees are still more highly selected on a variety of dimensions that men and, we like to think, just a shade smarter.

We expect that differential to even out or disappear as the numbers get more nearly equal. The changes in curricular patterns have been occurring simultaneously at all levels: high school, college, graduate work. Based on those facts I think we can predict with confidence that the numbers of women scientists will continue to increase substantially for at least another decade. That's about as far ahead as we can project those trends with any amount of reason.

Those facts have the very important consequence that on the whole women are and will continue to be a rapidly growing part of the single most important segment of the scientific world force--the freshly trained young scientists who are at the forefront of their fields and whose work continually reshapes those frontiers of knowledge. Again I think it's important to publicize the fact and to use it much more consciously for political leverage. When you are five or ten percent of a work force nobody is going to pay an enormous amount of attention; when you get to be 20 or

25 percent, no one can afford to ignore you.

The question remains: when science is patently unfair to women and when discrimination in hiring, promotion and pay persists, why should increasing numbers of women go into science? I think the answer is that there aren't very good alternatives; in all other fields there is at least as much discrimination, if not a great deal more. To this extent I certainly agree with Professor Cole. The tradition of merit in science and the faith that cream rises to the top is, I think, responsible for rather less discrimination in the fields of science than we find in many other professions. For example, job and pay differentials for MBA's, who are such hot items nowadays, far exceed the worst case in the sciences. That happens to be chemistry, where you need more that 20 percent additional experience in order to achieve an almost 30 percent salary differential compared to your male counterpart. There are times when the situation in chemistry has been so bad that people have left the field altogether. One of those who left the field is visiting in Washington right now and is apparently doing well as Prime Minister of Great Britain.

Let me say something about Affirmative Action. I agree with Anne Briscoe that it has given an enormous boost to us in the move toward equality. But I think the fact that it is going to be soft pedaled, if not abandoned altogether in the next few months, is possibly not as serious as we might be afraid. The reason is precisely the growing numbers, the

growing political power within science and in the shaping of public policies concerning science that women are clearly demonstrating. I think we will survive even if we don't have Affirmative Action. I would hate to see it go, but it's useful to remember that it never did do very much for anyone at professional levels; it was aimed, at least initially, at larger numbers of people at blue collar levels.

I want to add just a word about choosing where you go to work. It is important to manage your careers, as Dr. Cole said. And I don't believe that men manage them any better; it's just that they don't have to consider all the alternatives. Men go into rather pre-set career patterns and many of the decisions are made for them. It is not only assumed that they will move up in their jobs; they are pushed along. They don't have to decide that they will move up in most cases. Women still have to take the steps for themselves. But women scientists have traditionally gone almost exclusively into academic employment. It's not as badly skewed as some people would have you believe, because the field distributions of male and female scientists are so different. The reason there are so many more male scientists in industry is that there are so many more men who are engineers, physicists and physical chemists. Industry has not been a hospitable employer of women in the past, but it has seen the light for whatever reason and I think it knows a bargain when it sees one. In the last five years the rate of hiring of women scientists in industry has

doubled--an astonishing rate of increase.

We are in fact very interested in why there are not more women going into industrial employment, and we'd like somebody to pay us to investigate the matter. But in the meantime I would suggest to all of you, whatever field you're in, that you give very serious consideration to industrial employment. It is much more flexible in many ways. You can make an excellent career in industry in many fields with less than a Ph.D.--something that is not a possibility in academia. There are excellent opportunities there.

National trends are not the only thing you need to be concerned about. You need to worry about what's happening in the area where you live, if that is the area you are tied to. If you're free to move, then you do quite a different sort of analysis and you look for the geographical area with the most opportunities in the fields you want to be in.

I want to urge you all very earnestly to use career services offices in your institutions; they are full of valuable information that the vast majority of students neglect.

Equality has been something of a moving target over the last decade. Each time we have surmounted one barrier, someone has put another bar on top of the next one. I think all we can do about that is to continue to attack the barrier and sharpen our aim at that moving target.

Eileen Poiani:

I would like to add my warm hello to the sequence of welcomes you have had this morning and to thank Womanspace for inviting me to share this panel and be a member of this distinguished group today.

To me, the happiest fact of this occasion is that you are all here and that resources like Womanspace are available to you. Whether you are entering or re-entering the labor force, changing or moving up in your career as I understand most of you are, I believe as do the other panelists that you have picked the perfect time.

Mathematics and science have never before received so much popular attention; just think of all the fuss about math anxiety and Carl Sagan's "Cosmos". We might even say it's downright upright for women to be in these fields.

Perhaps it is symbolic too that as the lone mathematician on the panel I am the last speaker. I'm sure you've heard that mathematics is sometimes dubbed the queen of the sciences, and we like to believe that it is necessary for and applicable to all of the disciplines that my colleagues represent. As sociologist Lucy Sells has said, "Mathematics is the critical filter in career access for jobs requiring either college or non-college training." But many women, even those of you who are in the sciences, have been filtered out of some career options by inadequate preparation in mathematics and math related pursuits. I'd like to touch briefly on some statements on the real status of women in math today and then go

on to a few more specifics.

As you know from much media attention, the fact that young women, sometimes two to three times as many as men, traditionally avoid mathematics after fulfilling the basic requirement in high school. To explore all the reasons for that avoidance would take a conference in itself. Suffice it to say that 300 years after the invention of calculus, many women are under-prepared to take calculus and, as a result, have been filtered out of many of the natural, physical and biological sciences, computer science, and some areas of accounting and psychology. Many of the statistics that my colleagues have mentioned today reflect this fact.

Math avoidance has left many women with only the options of traditionally female occupations in lower paying, non-technical fields. Just think of some of the recent studies that indicate that petroleum engineers at entry make about $1800 per month while people in the humanities make only $900. From 1936 to 1978, it is estimated that ten percent of the Ph.D.'s granted in math, science and engineering were awarded to women. There have been increases in the number of women holding Ph.D.'s, but during this period only eight percent were granted in mathematics, seven percent in chemistry, one percent in engineering and, at the upper end of the spectrum, about 18 percent in biology. The numbers and the proportionate representation of women in these fields requiring a great deal of mathematical preparation is unfortunately disproportionately low.

Nevertheless, things are improving; you've heard some instances of that from the other panelists. There are a number of special programs out there like the one I'm involved with, Women and Mathematics, to encourage young women to take more mathematics. The Mathematical Association of America sponsors the organization, and we've been fortunate to get corporate support from IBM and other corporations. I believe it is programs like these that will help make students, parents, teachers, and counselors aware of why taking enough mathematics helps to keep a lot of career doors open and not taking enough, closes them. As I mentioned, things are improving. In 1980 the Census Bureau report indicated that four to six times as many women were majoring in traditionally male dominated fields of business and engineering in 1978 as a dozen years before. In certain parts of the country more young women are now taking more mathematics.

Well now, what does that have to do with you? Some of you are obviously hooked on mathematics and others, I suspect, are not. Within this context I would like to make a few general assumptions and then direct my remarks to two special groups in the audience. Based on a number of recent studies, including the Southern Regional Educational Board study, we know that there will be a shortage of high-technology trained people in the next decade--people in engineering, mathematics, computer science and the hard sciences. These are among the highest paid jobs. Secondly,

the shortage will be accentuated by national priorities that will probably expand basic research and development. Third, retooling into some technical fields for those of you who are already in the labor market will help fill vacancies and offer some chance for mobility up the career ladder. And fourth, the unfortunate lack of interest in teaching mathematics, as well as science, is reaching crisis proportions.

Where will we find the people to fill these slots? Unfortunately, enrollment projections indicate that colleges are facing the crisis of declining enrollment. But in the next decade and in fact the next couple of decades, well over half the enrollees will be women and, hopefully, increasing proportions of minority students. The demand for high technology jobs will have to be met in large measure by women and minorities. I encourage you to encourage your own daughters and friends and sisters to avoid math avoidance, to take enough years of math so that they will be prepared to keep all career doors open. Those of you who now are or were math majors, or those of you who are science majors with a flair for mathematics, I'd like you to consider a few alternatives for your own futures. As you know, the pendulum in mathematics as in the sciences inevitably swings between the pure and applied branches. We have come to a period where interest in applied mathematics is very important, and it will continue to be. At the same time, there is believed to be an increasing surge of interest in pure

research. I would say that if your degree was earned before 1970, it probably was in pure mathematics, and at this stage of the game it is not that marketable. I would urge those of you in that position to take some applied courses in mathematics, computer science, ecology, statistics, economics--in other words, to develop a specialty. Some of the other panelists have alluded to this before. But I would also urge you to consider not only a specialty in a collateral scientific area, but also one in a non-technical concentration if that's your bent. It might be journalism or language or business--something to give a unique mix that an employer won't be able to resist.

If on the other hand you have time, energy and money and are willing to pursue a masters degree if you do not have one, then that actual credential could prove to be your union card. Computer science is an open field; it has been estimated that the supply is less than 40 percent of the demand. There is tremendous demand in the areas of pure science and operations research, in economics, in actuarial science and even in finance.

I would suggest to you that there are very few women in the academic world in the area of finance, and it is an ideal place for someone with quantitative skills to think about looking for a position. And while I'm mentioning the academic world, don't let me neglect the library. I suggest some of you may want to combine your math or science skills with skills in library science. There are a number of fine

jobs available in libraries for people with computer training. I mention this because library direction is an area where women have definitely not moved up the ladder. Those filling the professional librarian positions have often lacked the management and scientific skills to move up in management. So if that is your area of interest, I would urge you to consider tooling up for it.

I mention mathematics education. There is indeed a lack of sufficiently trained and sufficiently enthusiastic teachers of mathematics. There is also a lack of sufficient training for many people on the elementary level of teaching mathematics. If you still have an interest in the academic world at those levels I would urge you to consider moving in there.

A great deal has been said this morning about the problems of teaching in the colleges. The fact is that jobs will be very scarce through 1990. If your goal is to pursue the doctorate, which is the basic credential for a career in college teaching, if you are highly motivated and if you recognize the obstacles, then I would suggest that you choose a specialty which will allow you choices in the future, in an area like computer science where there is high demand.

Just as an aside, there was an article recently in the Chronicle of Higher Education indicating that the computer science teaching market is probably the tightest. Naturally people are lured to industry and are not interested in teaching on the college level in computer science. Most of

our faculty members are part-time people who only give a little extra time from their industrial jobs. Computer science is an area where professors are highly in demand. As you know and as I've been mentioning, the status of women in higher education mathematics today remains grim. Less than five percent of the tenured mathematics positions are held by women. The positions held by women in the most prestigious universities on the average offer substantially lower salaries. But nevertheless I do believe in being optimistic. Things are changing slowly but surely and there are growing opportunities out there, in the classroom and in educational administration, in planning and in research.

Now I'd like to speak to those of you who were or are non-math majors, who just endured mathematics. You have many choices too. First, you could choose a career which avoids mathematics as well; I'm not sure there are any, but perhaps you can search one out. Secondly, you can brace yourself and take some mathematics or math-related courses and dabble in some of the areas I've already mentioned. Or third, you can hone your scientific skills according to the advice presented by my fellow panelists. Regardless or your bent, I suspect you are realizing that mathematics is a critical filter and that there is a possibility of combining some of your own skills in science with math-related skills.

In closing, let me share with you a quote which is a reminder of the impact of technology on our individual and collective lives.

In all the history of the world, there has never been a period in which so many significant changes have occurred in so short a span of time. Accommodation to change and the thoughtful pursuit of alternative futures is the key to survival of civilization and certainly to looking ahead to your own individual future.

The choices are really limitless, and I certainly wish all of you the best of luck in choosing.

(Following the Keynote Speech and Panel Discussion, 19 separate workshops on opportunities in mathematics and science careers were held. All proceedings were taped and are available at Womanspace: Career Options Program for Women, 211 Lewisohn Hall, Columbia University. Profiles of conference planners, keynote speaker, workshop leaders, and morning panelists follow.)

GROWING OPPORTUNITIES FOR WOMEN IN MATHEMATICS AND SCIENCE CONFERENCE

February 28, 1981

Biographies of Presentors and Sponsors

JANICE M. BALLOU - An Overview of Research - Overview Session D

Janice M. Ballou is Associate Director of the Eagleton Poll, a regular survey of public opinion in New Jersey. She holds a B.A. from Douglass College and an M.A. from Rutgers University, where she was awarded an Eagleton Fellowship.

MADELINE BOHMAN - Health Care Administration - Workshop # 10

Madeline Bohman, Executive Director of Bellevue Hospital Center, earned her Diploma in Nursing from the Bellevue School of Nursing, her B.S. from Columbia University's School of General Studies and her M.B.A. in Hospital Administration from Wagner College. She has taught at the New York University School of Medicine and the Hunter College, Bellevue School of Nursing and has served as Preceptor in Hospital Administration for Columbia University, Wagner College, New York University, and Baruch College. Prior to her appointment in 1978 as Executive Director she worked at Bellevue as a Staff Nurse, Head Nurse, Nursing Supervisor, and in various administrative positions.

ANNE M. BRISCOE - Morning Panelist

Anne Briscoe is a Professor of Biochemistry at Columbia University and Director of the Biochemistry Laboratory at the College of Physicians and Surgeons, Harlem Hospital Center. Dr. Briscoe has had a long and distinguished career in teaching in the Health Sciences and research in Metabolism and Endocrinology. She received her M.A. from Vassar College and her Ph.D. in Biochemistry from Yale University and was both a Yale Sterling Junior Fellow and a National Institute of Health Fellow. She was a Career Scientist of the New York City Health Research Council, National President of the Association of Women in Science, and Treasurer of the Federation of Organizations for Professional Women. Currently she is on the Board of Governors of the New York Academy of Science where she also chairs the Women in Science Committee, a member of the New York City Commission of the Status of Women and President of AWIS.

ELOISE ELIZABETH CLARK - Keynote Speaker

Dr. Clark joined the National Science Foundation in 1969 as Program Director for Developmental Biology. She was appointed to her present position as Assistant Director, Directorate for Biological, Behavioral and Social Sciences in 1976. Dr. Clark completed a B.A. at Mary Washington College of the University of Virginia and the Ph.D. in Developmental Biology at the University of North Carolina. She currently serves on two White House committees: the Interdepartmental Task Force on Women and the Interagency Task Force for the Conference on Families. Active in many professional

societies, she is currently on the Board of Directors of the American Association for the Advancement of Science.

BEVERLY S. COHEN - Environmental Health and Science - Workshop # 7

Beverly S. Cohen, Assistant Professor at New York University Medical Center's Department of Environmental Medicine, was awarded her B.A. in Physics from Bryn Mawr, attended Cornell University and the School of General Studies at Columbia, and earned her Ph.D. in Environmental Health Sciences from New York University in 1979. She also is certified in Radiological Physics through the American College of Radiology. A member of many professional organizations and the recipient of many awards and fellowships, she has done research and taught at the Columbia University College of Physicians and Surgeons and Mount St. Mary College prior to joining the faculty of New York University Medical Center. Dr. Cohen is the author of several professional articles related to cancer research and cigarette smoking. She is married and has three sons.

JONATHAN R. COLE - Morning Panelist

Jonathan R. Cole, Professor of Sociology, is the Director of the Center for the Social Sciences at Columbia University. He earned both the B.A. and Ph.D. in Sociology at Columbia. He is the author of many articles and several books, one of which is Fair Science: Women in the Scientific Community published in 1979.

LORRAINE DENBY - Statistics - Workshop # 14

Lorraine Denby, an Associate Member of the Technical Staff at Bell Laboratories, is a Statistician. She holds a B.S. in Mathematics with a Minor in Physics and an M.S. in Statistics from the University of Michigan and is currently writing a dissertation for a Ph.D. in Statistics. Ms. Denby has been at Bell Laboratories since 1972 and has published several articles in her field. She is also participant in the Women and Mathematics Lecture Series.

WARD HALDAN DENNIS - Conference Sponsor

Ward H. Dennis, Dean of the School of General Studies at Columbia University, was both Associate Dean and Acting Dean of the School before his appointment in 1977 to his present position. He holds an A.B. from Middlebury College and Ph.D. from Columbia University. A former professor of Spanish at Columbia, Dean Dennis was a co-founder of the University Seminar on Latin America and Director of the Latin American Institute. Author of a book and numerous articles and reviews in his field, he was a Fulbright-Hays Scholar in Quito, Ecuador, in 1974. In 1977 Dean Dennis authorized the funds which resulted in the founding of Womanspace.

LORNA DUPHINEY EDMUNDSON - Conference Sponsor

Lorna Duphiney Edmundson, the Founding Director of Womanspace: Career Options Program for Women at Columbia University, is a specialist in Applied Human Development and Guidance with experience in counseling, teaching, research, program development and administration in the United States and France. She holds an Ed.B. from Rhode Island College, an M.A. from Boston College, and an Ed.D. from Columbia University's Teachers College. In 1976 she co-founded what is now the Women's Institute at the American College in Paris. In addition to her work at Columbia, Dr. Edmundson currently conducts a private counseling practice and is a member of the Metropolitan Area Planning Committee of the American Council on Education's National Identification Program for women administrators in higher education.

FRANCINE ESSIEN - Morning Panelist

Francine Essien, Associate Professor in the Department of Biological Studies, Douglass College, earned a B.A. in Biology from Temple University and a Ph.D. in Genetics from Einstein College of Medicine. She has also been a post-doctoral fellow in Cell and Molecular Biology at the University of Connecticut. She is the author of several articles for professional journals and has been active in many professional organizations. Currently she is a consultant for the American Council on Education. She is married and is the mother of two children.

JESSICA GORDON - Computers and Data Processing - Workshop # 4

Jessica Gordon, the Assistant Director for Computing Activities at Columbia University, has a B.A. in Mathematics from Bryn Mawr, an M.A. in Mathematics Education from Columbia, and is a Ph.D. candidate at Teachers College, Columbia. She has been working in data processing since 1956, including jobs with IBM, Woods Hole Oceanographic Institution and Massachusetts Institute of Technology. Since coming to Columbia in 1964, she has taught programming in the School of International Affairs, the Graduate School of Business, the School of Engineering and the Division of Continuing Education. She is the author of a textbook on Computer Programming and other computer-related publications.

ELAINE E. GRANT - Alternatives in Medicine - Workshop # 1

Elaine Grant, the Executive Director of the Yale School of Medicine's Physician Associate Program, graduated in 1974 as a Physician Assistant from the same program she now directs. Before beginning her studies at Yale, she studied Political Science and Urban Studies, taught elementary school and spent eight years raising her two children. Immediately following her graduation from Yale, she practiced clinically in the area of substance abuse.

LILLI HORNIG - Morning Panelist

Lilli Hornig is the Executive Director of the Higher Education Resources Services, which is located at Wellesley College. HERS conducts research on women in Higher Education and programs to improve the status of academic professional women. Dr. Hornig has a B.A. from Bryn Mawr College and a Ph.D. in Chemistry from Harvard University. She has been a faculty member at Brown University and Trinity College, Washington, D.C., where she also chaired the Chemistry Department. Her chemical research interests are in the area of mechanisms by which chemical substances produce cancer. She is a member of the National Academy of Science's Commission on Human Resources and is the Chair of its Committee on the Education and Employment of Women in Science and Engineering.

PATRICIA KEARNEY - An Overview of Computers and Data Processing - Overview Session A

Patricia Kearney, Systems Director of Programming Products for IBM Corporation in White Plains, holds a B.S. in Political Science from Cortland State College (New York). She started her career in Data Processing in 1968 as an Application Programmer with a small company in San Diego, joined IBM in 1969 and began her management responsibilities there in 1973. In 1980 Ms. Kearney was elected to the Academy of Women Achievers, an honorary association sponsored by the YWCA.

DIONA KOERNER - Biology - Workshop # 2

Diona Koerner obtained a Ph.D. in Biological Chemistry from the University of London, England in 1961 and is currently an Associate Professor of Biochemistry at Marymount College in Tarrytown, New York. Previously Dr. Koerner was Assistant Professor of Biochemistry at the Albert Einstein College of Medicine and a research associate at Montefiore Hospital, Bronx, New York. She is the author of many scientific publications and her research has been directed towards the elucidation of the molecular mechanism of hormone action. Dr. Koerner is president of the Metropolitan New York chapter of the Association for Women in Science, and is actively engaged in promoting the interests of women in science.

JACQUELINE LEAVITT - Urban Planning - Workshop # 15

Jacqueline Leavitt, Assistant Professor at Columbia University's School of Architecture and Planning, has held positions as an Urban Planner in both government and private agencies, and has taught Urban Planning for the past fifteen years. Dr. Leavitt has been a consultant to the U.S. Housing and Urban Development Department on research issues concerning women. Her publications include material on housing and women in Urban Planning. She received her Ph.D. from Columbia in 1980.

ANNA KAZANJIAN LONGOBARDO - Engineering - Workshop # 6

Anna Kazanjian Longobardo, Manager of Program Planning, Sperry Systems Management, is responsible for analyzing and recommending new markets and product areas. She began working at the Sperry Rand Corporation in 1965 in the Sperry Gyroscope Division following fifteen years with the American Bosch Arma Corporation. There, as a Senior Systems Engineer, she was responsible for analytical studies of inertial guidance systems for space vehicles. The first woman to earn a B.S. and an M.S. in Medical Engineering at Columbia University, Ms. Longobardo was awarded the Columbia University Alumni Medal in 1980. She is married and the mother of two children.

EILEEN L. POIANI - Morning Panelist

Eileen L. Poiani, Assistant to the President and Professor of Mathematics at St. Peter's College in Jersey City, is National Director of WAM (Women and Mathematics programs), sponsored by the Mathematical Association of America. She holds a B.A. from Douglass College and M.S. and Ph.D. in Mathematics from Rutgers University. She has been very active in various capacities for the MAA, and currently is a member of the New Jersey Department of Higher Education Advisory Commission on Statewide Education Research. She was named Outstanding Educator of America in 1973 and 1975.

MARTHA QUESADA - Chemistry and Physics - Workshop # 3

Martha Quesada is a Senior Research Chemist at Merck, Sharp and Dohme Research Laboratories in Rahway, New Jersey. She earned her B.A., M.S. and Ph.D. at the University of Rochester and, in addition, has done post-doctoral study at Columbia University. Dr. Quesada has published several articles on synthetic organic chemistry in the Journal of Organic Chemistry and Journal of the American Chemical Society.

ELEANOR EKBLADE SEAMAN - Conference Coordinator

Eleanor Ekblade Seaman is a doctoral student at Teachers College, Columbia University, where she is doing research on "Math Anxiety" in the Department of Mathematics, Statistics, and Computing in Education. She is currently on leave from her position of Assistant Professor of Mathematics at Quinnipiac College, Hamden, Connecticut. She became involved at Womanspace in the fall of 1980 as an intern as part of her graduate study. She is a re-entry student herself and is the mother of two grown children.

DIANE DWAN SHENG - Operations Research - Workshop # 13

Diane Dwan Sheng has been doing theoretical and applied research for two and a half years as an employee of Bell Laboratories, the "think tank" arm of A.T.&T. Her area of special interest is Applied Probability. She is a frequent lecturer for the Women and Mathematics (WAM) programs in New Jersey. She received her Ph.D. in Operations Research from Stanford University.

JOANNE STEPHAN - An Overview of the Health Sciences - Overview C

Joanne Stephan, Director of Allied Health Programs, College of Physicians and Surgeons, Columbia University, holds an Sc.D. in Biochemistry from the School of Public Health, Johns Hopkins University. Prior to earning her degree, Dr. Stephan worked for ten years as a certified Medical Technologist in all aspects of that field, including teaching.

CARLA SYDNEY STONE - Energy - Workshop # 5

Carla Sydney Stone has been employed by Conoco, Inc. since 1977 and is presently Commercial Development Representative for Conoco Coal Development Company. She earned a B.S. and M.S. in Mineral Engineering from Columbia University's Henry Krumb School of Mines and is a past president of the Columbia University Society of Women Engineers. In addition to her current position, she has worked in environmental law, finance and economics. A White House Fellow finalist, Ms. Stone currently chairs the American Institute of Mining Engineers Council of Economics. She is married and has one child.

JOYCE TOPPIN - Government Research - Workshop # 9

Joyce Toppin, Assistant Area Manager of the Newark Area Office of Personnel Management, received a B.A. from the Baruch College and an M.A. in Counseling from New York University. She joined the Civil Service in 1972 as a Personnel Management Specialist and assumed her present position in 1976. Prior to her federal experience, she held various positions in private industry and in the New York State Department of Labor.

KATHERINE VALYI - An Overview of Energy and the Environment - Overview B

Katherine Valyi, Marine Sales Coordinator, Eastern Hemisphere Division of Exxon International Marine Sales, has responsibility for price and supply coordination in Canada, South America, the Caribbean, South Africa and the Arabian Gulf. She first became interested in the problems of energy during her junior year abroad in Morocco and Lebanon. She earned a B.A. in History from Carleton College and an M.A. from the Johns Hopkins University School of Advanced International Studies before joining Exxon in 1976. She has also held a number of public affairs research positions, including one in the office of former New York City Mayor James Cavanaugh. She is married and the mother of one child.

NANCY VOYE - Financial Analysis - Workshop # 8

Nancy Voye, a Project Coordinator for Conoco, Inc., has an A.B. from Connecticut College in History, an M.A. from Boston University in American and New England Studies and an M.B.A. from the Columbia Graduate School of Business with joint concentration in Finance and Accounting. She joined Conoco as an Analyst in 1970 and is presently a Project Coordinator in the Financial Analysis Division, Coordination and Planning Department.

SUSAN WOLFORD - Medical and Scientific Writing - Workshop # 12

Susan Wolford is a Senior Research Biologist and Manager of the Toxicology Technical Information Group at Lederle Laboratories, a division of American Cyanamid in Pearl River, New York. Dr. Wolford served as a Teaching Assistant and Research Assistant at the University of Illinois (Urbana) while working on her Ph.D. in Food Chemistry. She joined Lederle Laboratories in 1979 in her present position.

MIRIAM ZAID - Health Information and Education - Workshop # 11

Miriam Zaid received a B.S. in Community Health Education from the Institute of Health Science, Hunter College and an M.P.H. in Public Health from Columbia University. After ten years of experience as Vice-President and General Manager of a proprietary engineering and development company, Mrs. Zaid transferred her skills to the field of Health Care Administration, holding various positions in both the public and private health sectors. In her last position she developed health promotion programs for schools and the community-at-large. She is presently self-employed as a health education consultant.